ЕКОНОМІКО-МАТЕМАТИЧНЕ МОДЕЛЮВАННЯ БІЗНЕСОВИХ ПРОЦЕСІВ

УДК 330.3:330.4
JEL classification: E22, C43, L65
DOI: 10.20535/2307-5651.15.2018.136541

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ECONOMIC ANALYSIS OF THE PHARMACEUTICAL ENTERPRISE ON THE PERSPECTIVE OF INNOVATIVE DEVELOPMENT AT THE EXAMPLE OF FARMAK JSC

ЕКОНОМІЧНИЙ АНАЛІЗ ФАРМАЦЕВТИЧНОГО ПІДПРИЄМСТВА ЩОДО ПЕРСПЕКТИВИ ІННОВАЦІЙНОГО РОЗВИТКУ НА ПРИКЛАДІ ПАТ «ФАРМАК»

The article considers the problem of development and competitiveness of the pharmaceutical industry companies of Ukraine as one of the leading knowledge-intensive and profitable industries in the world. The importance of development of the pharmaceutical market as one of the elements of ensuring the national security of the state is emphasized. The problem of innovation and technological development of Ukrainian economy sectors is defined as central in modern economic conditions. It is noted that it is necessary to use advanced concepts, methods and management tools in order to ensure the stable development of the pharmaceutical industry. The prospects of diversification of the product portfolio with innovative developments by attracting foreign investments are investigated. The possibility of the pharmaceutical industry turn to the international standards of development, research, production and product certification is analyzed, since the possibility of innovation development is the main factor of competitiveness of such high-tech industries as pharmaceutical. The financial and economic situation of Ukraine pharmaceutical industry in the context of the main financial indicators is investigated. Despite the systemic macroeconomic downturn in industrial production across the country, data was provided confirming a steady trend towards increasing sales of domestic pharmaceuticals enterprises. The results of the analysis and determination of the possibility of providing innovation development are interpreted on the example of Farmak JSC as it is one of the leading pharmaceutical industry companies. The economic data of the company, financial-economic analysis elements and determination of the financial stability degree with the help of the fuzzy logic apparatus were used for the research. The article confirmed the idea of the importance of investing in technological innovation. Directions of potential future researches are determined.

Keywords: competitiveness, economic analysis, pharmaceutical industry, financial stability, fuzzy logic apparatus, risk of bankruptcy.

У статті розглянуто проблему розвитку та конкурентоспроможності підприємств фармацевтичної галузі України як однієї з провідних наукоємних та прибуткових галузей діяльності у світі. Наголошено на важливості розвитку фармацевтичного ринку як одного з елементів забезпечення національної безпеки держави. Проблему інноваційного та технологічного розвитку галузей української економіки визначено як центральну в сучасних економічних умовах. Зазначено, що задля забезпечення стабільного розвитку фармацевтичної індустрії необхідним є використання передових концепцій, методів та інструментів менеджменту. Досліджено перспективи

урізноманітнення продуктового портфелю інноваційними розробками за рахунок залучення зовнішніх інвестицій. Проаналізовано можливість переходу фармацевтичної галузі на міжнародні стандарти розробки, досліджень, виробництва та сертифікації продукції, так як можливість інноваційного розвитку є основним фактором конкурентоспроможності таких високотехнологічних галузей промисловості як фармацевтика. Досліджено фінансово-економічне становище фармацевтичної галузі України у розрізі основних фінансових показників. Незважаючи на системний макроекономічний спад промислового виробництва по країні, були приведені дані, що підтверджують стійкий тренд до зростання обсягів продажу фармацевтичної продукції вітчизняних підприємств. Інтерпретовано результати аналізу та визначення можливості забезпечення інноваційного розвитку на прикладі ПАТ «Фармак» як одного з підприємств-лідерів фармацевтичної промисловості, використовуючи економічні дані підприємства, елементи фінансово-економічного аналізу та визначення ступеня фінансової стійкості за допомогою апарату нечіткої логіки. В статті була підтверджена думка щодо важливості проведення інвестицій у технологічні інновації. Визначено напрями потенційних майбутніх досліджень.

Ключові слова: конкурентоспроможність, економічний аналіз, фармацевтична промисловість, фінансова стійкість, апарат нечіткої логіки, ступінь ризику банкрутства.

Introduction. Today there is a real problem of company's competitiveness in Ukraine. Development and updating of enterprises need significant investments, and this concerns the pharmaceutical industry first of all, as it is a socially responsible industry, and the products quality should be at a high level. Many scientists paid attention to the analysis of the enterprise business and its competitiveness. These aspects were covered in articles by O.D. Bury, I.A. Zupanets, R.V. Fedorovich, A.O. Nedosekin.

Setting objectives. The purpose of the article is to determine if the pharmaceutical company is capable to improve production quality and implement innovative technologies in accordance with international standards with the aim of maintaining market leadership, expanding product portfolio, meeting the consumer's needs and entering new markets.

Methodology. Theoretical and methodological basis of work is the scientific works of domestic and foreign scientists on the economic analysis of the enterprise. To achieve this goal the following research methods such as fuzzy logic apparatus, analysis, synthesis, comparison and deductive method had been used.

Research results. In the international competitiveness rating, calculated by the World Economic Forum (WEF), Ukraine for 2017-2018 compared with, for example, 2015-2016 dropped from 79th to 81st (out of 148 countries around the world). The problem of competitiveness is universal and global. Now it affects mostly all countries around the world, all business structures and manufacturers. The development of the pharmaceutical market is a stability basis of the country and it is one of the elements that ensure the national security of Ukraine, which is largely dependent on the situation of the country economy.

In today's conditions of close cooperation between Ukrainian and foreign entrepreneurs, the problem of innovative and technological development of Ukrainian industries has become central. The growth of competition in the national pharmaceutical market has led many companies to seek fundamentally new development models, to develop a new philosophy of their activities. So, the slogan of leading pharmaceutical companies is to improve the life quality of the

population. The research costs are increasing, which makes it possible to improve products quality. The need for the health life of the population determines the special place of the pharmaceutical industry and the need to use modern concepts, methods and tools of management at all levels to ensure sustainable development. Today, the leading trend in the domestic pharmaceutical industry is the sustainable development of the pharmaceutical company in accordance with the requirements of Good Manufacturing Practice (GMP), which requires the proper construction of quality management systems.

The Ukrainian market includes production of medicines and medical products, wholesale and retail medicine sales through pharmacy networks, specialized storage, distribution, export and import of products.

During the years 2010-2016, Ukrainian pharmaceutical companies gradually continued to increase the volume of sales revenue (Figure 1).

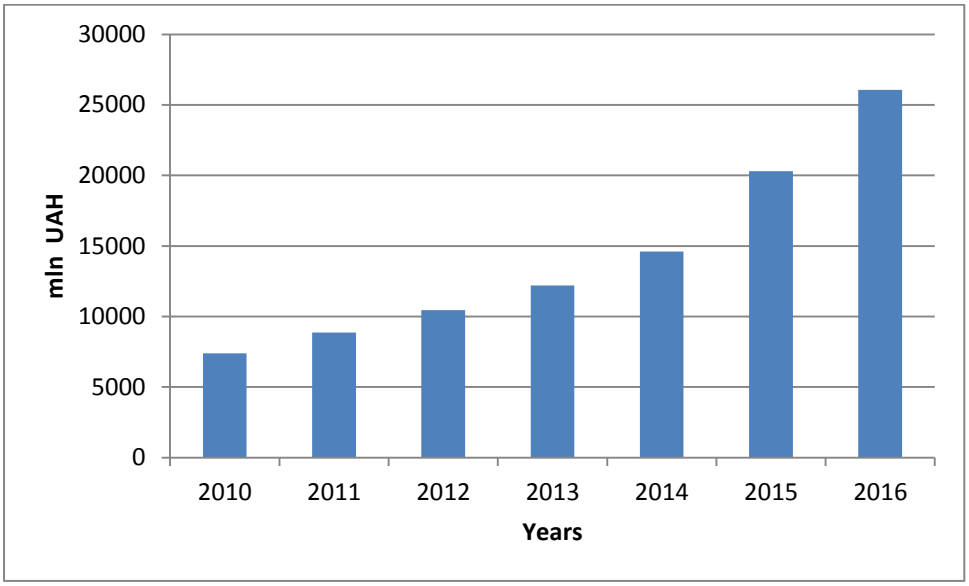

Figure 1 − Sales volumes dynamics of the Ukraine pharmaceutical industry (UAH million)

The largest manufacturers of pharmaceutical products are: Farmak JSC, Arterium Corporation, Darnitsa PJSC, Borshchahivskiy Chemical Pharmaceutical Plant (BCPP), Zdorovie LLC and so on. The share of this five major manufacturing companies accounts for more than 50% of all production.

According to Eurostat, pharmaceutical industry is the undisputed leader among the other world high-tech industries in terms of creation of gross added value per occupied person. In addition, pharmaceutical industry accounts for about 19% of world R&D costs [2].

Let’s conduct an economic analysis of enterprise sustainability and readiness for the innovations implementing. In order to implement innovation in accordance with international standards some investment must be made, and significant enough. For this, it is necessary and inevitable to attract resources from outside, since most of its own resources are involved in turnover. It is therefore necessary to analyze the financial stability of the pharmaceutical company to see whether it is able to invest in its own development and technology innovation and to assess the prospects of the enterprise development.

Table 1 shows the analysis of the current Farmak's capital structure and its comparison with the capital structure of general pharmacy market. The percentage of non-current assets, compared with the industry as a whole, is more than half of the balance, which indicates a significant investment in non-current assets renovation. The percentage of debt capital has been increasing, that is, attracting resources from the outside is inevitable.

Table 1- Comparison of the Farmak JSC and pharmaceutical industry capital structures in 2014-2016, %

Indexes		**Farmak JSC**			**Pharmaceutical industry**		
		2014	**2015**	**2016**	**2014**	**2015**	**2016**
Assets	Non-current assets	58	53	53	4	41	40,7
	Current assets	42	47	47	6	59	59,3
Liabilities	Equity	64	61	57,7	46,1	45,7	47,2
	Long-term liabilities	1	9	9,3	18,9	17,3	16,8
	Current liabilities	26	30	33	35	37	36

Let's analyze the financial status of the main indicators:

1. coefficient of financial leverage, that shows how much long-term borrowings is used to finance the assets along with its own funds, this coefficient shows the company dependence on long-term liabilities;
2. liquidity ratio, that shows the company ability to provide its short-term liabilities with the most easily realized part of assets – current assets, and gives the most general assessment of the assets liquidity;
3. coefficient of maneuverability, that indicates which percent of equity is used to finance current operations, i.e. is invested in current assets, and which is capitalized;
4. coefficient of turnover, showing how many turns current assets made in a certain period;
5. coefficient of ROA, that shows the efficiency of using the company's assets to generate profits;
6. coefficient of autonomy, that shows company financial independence from external sources of financing its performance.

Table 2 - Key indexes of the Farmak JSC financial state in 2011-2016

Indexes	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Norm**
Coefficient of financial leverage, C_{lev}	0,085	0,031	0,162	0,149	0,123	0,133	→0
Liquidity ratio, C_{liq}	1,141	1,067	2,165	1,603	1,56	1,44	1,5-2
Coefficient of maneuverability, C_{man}	0,301	0,342	0,344	0,396	0,47	0,395	0,4-0,5
Coefficient of turnover, C_{trn}	1,059	1,039	1,05	1,068	1,15	1,3	>1
Return of assets, ROA	0,197	0,149	0,13	0,129	0,131	0,173	>0
Coefficient of autonomy, C_{aut}	0,644	0,631	0,709	0,637	0,619	0,589	>0,65

These calculations show the growing company dependence on long-term liabilities (C_{lev} increases), the coefficient of maneuverability C_{man} is low, that is, a small percent of capital is used in the current activity. The turnover rate C_{trn} is within the normal range but not high, that is, cash is turned approximately once a year, but the trend is going to increase. Regarding the *ROA*, the company is in a good position, and its financial autonomy (C_{aut}) is within the optimal level.

From this, it can be concluded that the company state is rather ambiguous, and it is necessary to determine how financially sustainable the enterprise is in terms of the economic security level.

The level of company economic security can be considered as a measure of reconciliation of its interests with the interests of external subjects, and any company interest is its interaction with the external subjects, as a result of which it receives profit, and for further profits growth intensive development is needed. In the absence of profits or, moreover, in losses we can't talk about meeting the company interests, and therefore the company has no economic security. To determine the level of economic security and the ability to attract external resources, let's determine the degree of company's durability, expressed as a risk of bankruptcy, using the above indicators of financial sustainability, with the help of the fuzzy logic apparatus.

At first, we introduce the basic linguistic sets and subsets of states [1]:

1. the linguistic variable E of the company states, which has five subsets:
   a) E_1 — a subset of "Marginal ill-being" states;
   b) E_2 — a subset of "Ill-being " states;
   c) E_3 — a subset of "Average quality" states;
   d) E_4 — a subset of "Comparative well-being" states;
   e) E_5 — a subset of "Marginal well-being" states;
2. the *G* set of bankruptcy risk degrees, corresponding to the set *E*, is divided into five subsets (takes values from 0 to 1):
   a) G_1 — a subset of "Marginal bankruptcy risk";
   b) G_2 — a subset of "High bankruptcy risk";
   c) G_3 — a subset of "Average bankruptcy risk";
   d) G_4 — a subset of "Low bankruptcy risk";
   e) G_5 — a subset of "Insignificant bankruptcy risk".
3. for an arbitrary individual financial index, the full set of its values X_i is divided into five subsets:
   a) B_{i1} — is a subset of "Very low level of the X_i";
   b) B_{i2} — is a subset of "Low level of the X_i";
   c) B_{i3} — is a subset of "Average level of the X_i";
   d) B_{i4} — is a subset of "High level of the X_i";
   e) B_{i5} — is a subset of "Very high level of the X_i".

It is worth noting that the condition of matching the sets *B*, *E* and *G* must be fulfilled.

At the second stage we build a set of indicators $X=\{X_i\}$ using financial sustainability indicators that are listed above. In step 3 a ranking is made, according to which each indicator X_i corresponds to the level of its significance r_i.

This set of indicators is equivalent, that is, all the indicators have the same meaning for the analysis:

$$r_i = \frac{1}{N}, \quad (1)$$

where N – the number of indicators on which the evaluation is carried out.

In our case $r_i = \frac{1}{6}$. At stage 4, classification of the company crash risk degree is carried out (Table 3).

Table 3 - Indexes classification rule

Value interval *G*	**Subset**
0,8<g<1	Marginal bankruptcy risk
0,6<g<0,8	High bankruptcy risk
0,4<g<0,6	Average bankruptcy risk
0,2<g<0,4	Low bankruptcy risk
0<g<0,2	Insignificant bankruptcy risk

Let's analyze the normative values of the indexes. C_{lev} shows the dependence on external loans, so it is optimal if this coefficient decreases. The coefficient of maneuverability C_{man}, which shows the degree of equity mobility, has a normative value of 0.2-0.5. C_{trn} should be at least 1, because it indicates the turns number of current assets in a period (year). Return of assets (*ROA*), or the efficiency of using company assets to generate profits, should be positive, it should be compared with the values of direct competitors. Normal value C_{liq} is considered to be 1,5-2,5, but not less than one. The C_{aut} is equal to 1 if all company assets are financed by own resources. Of course, in practice this is not possible, the norm is considered to be 60% [7].

Based on the analysis of the values of pharmaceutical companies financial stability indicators and their normative values, the selected indexes received the following classification (Table 4):

Table 4 - Classification of indexes values

Index	B_{i1}	B_{i2}	B_{i3}	B_{i4}	B_{i5}
X_1	x_1>0,4	0,3<x_1<0,4	0,15<x_1<0,3	0,1<x_1<0,15	x_1<0,1
X_2	x_2<0,9	0,9<x_2<1	1<x_2<1,5	1,5<x_2<2	x_2>2
X_3	x_3<0,1	0,2<x_3<0,3	0,3<x_3<0,4	0,4<x_3<0,45	x_3>0,45
X_4	x_4<0,9	0,9<x_4<1	1<x_4<1,1	1,1<x_4<1,5	x_4>1,5
X_5	x_5<0	0<x_5<0,01	0,01<x_5<0,08	0,08<x_5<0,3	x_5>0,3
X_6	x_6<0,15	0,15<x_6<0,25	0,25<x_6<0,45	0,45<x_6<0,65	x_6>0,65

Let's classify the value of *x* from Table 2 by the following rule:

$$\lambda_{ij} = \begin{cases} 1, if\ \ x_i\ is\ in\ the\ appropriate\ range\ of\ Table\ 4 \\ 0, if\ it\ isn't \end{cases} \quad (2)$$

where λ_{ij} – the level of belonging x_i to the set B_j.

The results are located in Table 5.

Table 5 - Estimation of current indexes values in 2011-2016

Index	B_{i1}	B_{i2}	B_{i3}	B_{i4}	B_{i5}
X_1	0/0/0/0/0/0	0/0/0/0/0/0	0/0/1/0/0/0	0/0/0/1/1/1	1/1/0/0/0/0
X_2	0/0/0/0/0/0	0/0/0/0/0/0	1/1/0/0/0/0	0/0/0/1/1/1	0/0/1/0/0/0
X_3	0/0/0/0/0/0	0/0/0/0/0/0	1/1/1/1/0/1	0/0/0/0/0/0	0/0/0/0/1/0
X_4	0/0/0/0/0/0	0/0/0/0/0/0	0/0/0/0/1/1	0/0/0/0/1/1	0/0/0/0/0/0
X_5	0/0/0/0/0/0	0/0/0/0/0/0	0/0/0/0/0/0	1/1/1/1/1/1	0/0/0/0/0/0
X_6	0/0/0/0/0/0	0/0/0/0/0/0	0/0/0/0/0/0	1/1/0/1/1/1	0/0/1/0/0/0

The essence of the financial conditions assessing method is in the double convolution of the data in Table 5. The evaluation is based on the formula:

$$g = \sum_{j=1}^{5} g_i \sum_{i=1}^{N} r_i \lambda_{ij}, \quad (3)$$

$$g_i = 0{,}9 - 0{,}2(j-1), \quad (4)$$

λ_{ij} is taken from the Table 4, r_i is calculated using (1).

The essence of (3)-(4) consists in the fact that the internal summation in (3) is carried out on the significance of the index, and the external one - on the nodal points of the five-level classification of the risk degree (Table 3). Thus, the resulting risk assessment is weighted by all indicators and qualitative levels of these indicators [6].

Thus, the following values of the bankruptcy risk degree by years were obtained:

$$g_{2011} = 0{,}37;\ g_{2012} = 0{,}37;\ g_{2013} = 0{,}33; g_{2014} = 0{,}36; g_{2015} = 0{,}27;\ g_{2016} = 0{,}32.$$

So we have the dynamic (Figure 2):

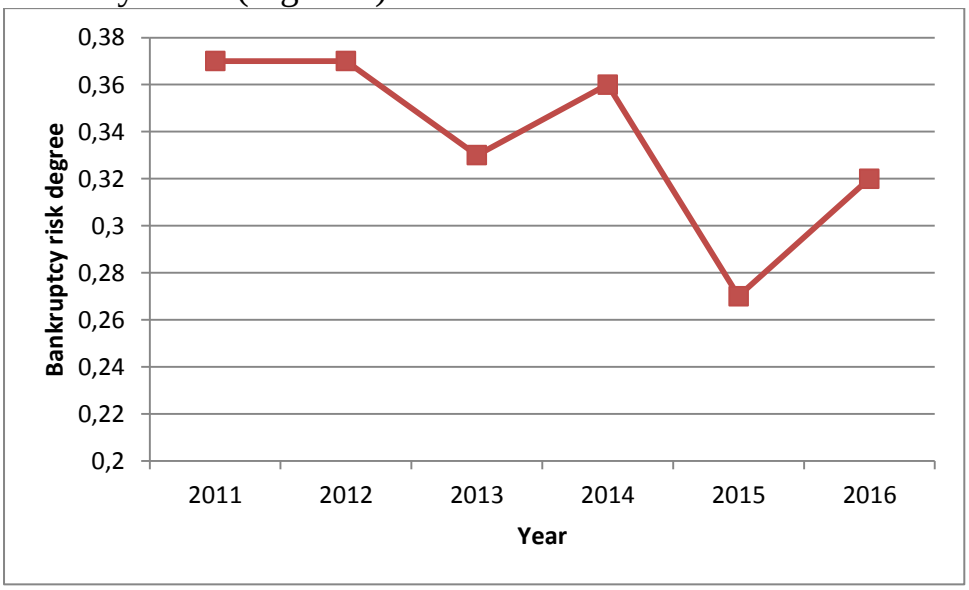

Figure 2 − The dynamic of bankruptcy risk degree

As we see, the overall trend is negative, that is, the company has worked stably and can build plans for attracting external resources. On average, the degree of company bankruptcy risk can be classified as low. The company is able to invest in technological development and improvement of product quality in order to maintain leadership positions and turn to international quality standards.

Conclusions. The company is a leader in the Ukrainian market and needs to improve its production, expand its product portfolio, improve the quality of medicines and create more original products. In order to do this, investments are necessary, and the analysis showed that this is possible and necessary. The theoretical and practical significance of the research results are that with the aid of a mathematical apparatus the enterprise can determine its financial position and adequately assess its capabilities, which will help to develop a strategy for business development for subsequent periods. In further research, there is a need to determine from where exactly we will take capital for technological development, and to develop a strategy for technological development of the company.

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УДК 338.242.2
JEL classification: C32, M37
DOI: 10.20535/2307-5651.15.2018.136576

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MODELING AN EFFECTIVE STRATEGY OF ADVERTISING INVESTMENTS OF FIRM IN THE COMPETITIVE MARKET

МОДЕЛЮВАННЯ ЕФЕКТИВНОЇ СТРАТЕГІЇ РЕКЛАМНИХ ВКЛАДЕНЬ ФІРМИ НА КОНКУРЕНТНОМУ РИНКУ

In this article, a dynamic model of the company's sales dependence on advertising costs is constructed. In a competitive market, advertising is not only a means of increasing demand, but also a competition tool at a level with the price. Advertising allows you to increase sales, but the dependence of increasing demand from increased advertising costs is not linear. If you increase your advertising costs after a certain value, their efficiency will decrease. This model takes into account the dependence of advertising efficiency on the change in the market share of advertising costs of the firm. It is shown that the complexity of capturing a new audience will grow geometrically, and therefore the efficiency of advertising will decrease geometrically.